

# Scanning the Past

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## Arthur E. Kennelly (1861–1939)

The PROCEEDINGS issue of 75 years ago (December 1916) included a paper on the measurement of skin-effect resistance of conductors at radio frequencies coauthored by the eminent electrical engineer and educator, Arthur E. Kennelly. At the time he was president of the Institute of Radio Engineers (IRE) and a faculty member of both Harvard University and the Massachusetts Institute of Technology (MIT). Also, he was born 130 years ago this month.

The 1916 paper, jointly authored by Herman A. Affel, a research assistant at MIT, reported on research carried out at MIT with financial support from the American Telephone and Telegraph Company. As a variable frequency source, Kennelly and Affel employed a 2-kW Alexanderson radio alternator which could generate frequencies up to 100 kHz at a rotor speed of 20 000 rpm. The machine had been constructed by the General Electric Company and was loaned to the investigators by the National Electric Signaling Company. The paper included theoretical curves and experimental data for skin effect resistance as a function of frequency for a variety of solid, tubular, and stranded conductors.

The December 1916 PROCEEDINGS also contained a paper by a British professor, E. W. Marchant, on the "Heaviside layer" as it then was known in Great Britain. Marchant wrote that it seemed that variations in the strength of radio signals at long distances could best be explained by reflections or refractions from a kind of "ionic fog." He stated that the exact cause of the ionized layer still was uncertain but he expressed confidence that it existed. Actually, Arthur Kennelly had proposed a reflecting ionosphere theory in a 1902 paper, the same year as Oliver Heaviside, and it became commonly known as the "Kennelly-Heaviside layer."

Kennelly had an exceptional career. He was born 17 December 1861 in India where his Irish father was employed as a harbormaster in Bombay. Kennelly's mother died when

he was three and he was sent to England and was educated both there and on the continent, becoming fluent in several languages. At the age of fourteen, he took a job as an office boy at the Society of Telegraph Engineers in London. In 1876 he joined the Eastern Telegraph Company and worked as a telegraph operator and as an engineer on ships laying submarine cable.

In 1887 Kennelly came to the United States and worked at Thomas Edison's laboratory in West Orange, New Jersey, until 1893 when he became a consulting engineer. That year he published a classic paper on impedance in the *Transactions of the American Institute of Electrical Engineers* (AIEE) in which he used complex quantities. His paper stimulated an editorial in the periodical *Electrical World* which credited him with having an "admirable faculty of taking an involved and little understood subject, and by a remarkably lucid...treatment placing it within the grasp of the merest tyro in electricity."

Kennelly joined the faculty of Harvard University in 1902 and taught there until 1930, also holding a joint appointment at MIT from 1913–1924. He served as president of the AIEE for two years (1898–1900) and was awarded its Edison Medal in 1933. He was IRE president in 1916 and received the IRE Medal of Honor in 1932. He was the sole author of ten books and coauthor of 18 more. He wrote more than 350 technical papers and more than 500 editorials for *Electrical World*. His eyesight failed during his last years, but he continued to be driven to his office and to write papers with the aid of a secretary who read current technical papers to him. He is said to have planned and used his time with great efficiency.

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